Jefferson fractures in children

Case report

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Jefferson fractures in children are exceedingly rare. A case in a 2-year-old is reported, and the other only case in the literature is reprinted. The mechanism of fracture is probably separation of the lateral masses by a force transmitted from the vertex. Because these fractures are not usually associated with neurological deficits, and because of the poor detail obtained with conventional radiography in a child, these fractures may be overlooked. Computerized tomography provides superb definition of this lesion. The preferred mode of treatment is immobilization.

KEY WORDS • atlas • children • computerized tomography • halo apparatus • Jefferson fracture • cervical spine

In 1920, Geoffrey Jefferson reported 46 cases of fractures of the atlas. Included among these were four of his own cases. This fracture, which now bears his name, is exceedingly unusual in children. Indeed, Jefferson's report from Sir Astley Cooper in 1822 is the only one to be found in the literature. This case is reprinted here as it is not readily accessible, and a new case in a 2-year-old is presented.

Case Reports

Case 1

This report is reproduced verbatim from Cooper's description.

"A boy, about three years of age, from a severe fall, injured his neck; and the following symptoms succeeded the accident, Mr. Cline was consulted. He was obliged to walk carefully upright as persons do when carrying a weight on the head, and when he wished to examine any object beneath him, he supported his chin upon his hands and gradually lowered his head, to enable him to direct his eyes downwards; but if the object was above him he placed both his hands upon the back of his head, and very gradually raised it until his eyes caught the point he wished to see. "If in playing with other children they ran against him, it produced a shock which caused great pain, and he was obliged to support his chin with his hand, and to go immediately to a table, upon which he placed his elbows, and thus supporting his head he remained a considerable time, until the effects of concussion had ceased. He died about twelve months after the accident, and upon the inspection of his body, which was conducted by Mr. Cline, he found the first vertebra of the neck broken across, so that the dentiform process of the second vertebra had so far lost its support, that under different inclinations of the head it required great care to prevent the spinal marrow from being compressed by it, and as he could not depend upon the actions of the muscles of the neck, he therefore used his hands to support the head during different motions and positions."

Case 2

This 2-year-old girl was climbing a tree with her brother when she fell from a branch approximately 5 feet above the ground and landed on the vertex of her head. She did not lose consciousness, but immediately complained of neck pain and was noted to have a head tilt. In the emergency department, she was found to be neurologically intact except for severe cervical muscle spasm and a head tilt. Plain x-ray films of the cervical spine revealed prevertebral soft-tissue swelling. Linear tomography (Fig. 1) demonstrated displacement of the lateral masses of C-1.
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FIG. 1. Linear 40° tomographic representation, anteroposterior view, of the injury. Due to poor contrast of the subject, the exact site of injury could not be defined. This level reveals marked lateral displacement of the articular pillars bilaterally.

FIG. 2. Unenhanced transverse computerized tomography scan at the C-1 vertebral level. Note the diastasis at the neurocentral synchondrosis (arrows) adjacent to the non-displaced fracture.

FIG. 3. Photograph of the plastic molded jacket with skull cap.

tomography (CT) confirmed the suspicion of a Jefferson-type fracture (Fig. 2).

The child was initially immobilized in a soft bulky cervical collar and was subsequently placed in a custom-made plastic brace* (Fig. 3). This was worn for 2 months, after which CT showed satisfactory healing of the fracture (Fig. 4). The child remained neurologically intact.

Discussion

The major point of discussion in this report is the anticipated controversy regarding the existence of the fracture itself. A similar radiological appearance may be due to a pseudo bilateral facet offset, which may occur in children because of a disparity in growth between the atlas and axis, or it may be a secondary ossification center not uncommon in children and well described by Von Torklus and Gehle. The lateral spread may also be due to simultaneous anterior and posterior clefts of the atlas. Combined defects may occur in association with partial occipitalization of the atlas. Our patient does not, however, fit any of these descriptions. In view of the clinical findings, the apparent fracture line demonstrated on CT, the subsequent healing, and the disparate neurocentral synchondroses, the authors feel that this entity represents a true osteochondral fracture.

Jefferson fractures are frequently defined as separation of the lateral masses secondary to disruption, anteriorly and posteriorly, of the bone ring. In fact, however, Jefferson described all fractures of the atlas vertebra. Both the anterior and posterior arch were fractured in only 10 of his cases. The posterior arch alone was fractured in 15, the anterior alone in six. The lateral masses alone were the site of fracture in five, and the lateral masses and the posterior arch in

* Plastic brace manufactured by Prescott's Orthotics and Prosthetics, San Antonio, Texas.
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Fig. 4. Unenhanced computerized tomography scan 8 weeks after immobilization was begun demonstrating no evidence of cartilaginous diastasis and a sclerotic focus, indicating healing at the previous fracture site.

two. The cases reported here thus comply with the criteria of Jefferson's fractures. The atlas ring, it seems, can be fractured at a single site. A fracture or second site of fracture could be overlooked on CT scanning if it is in the plane of the x-ray beam. The flexibility of the cartilaginous structures is the probable reason that this fracture is so rare in children, and is a possible explanation for a fracture at a single site.

Fractures of the cervical spine are rare in childhood, and fractures of the atlas are exceedingly so. The mechanism of fracture in our patient is probably separation of the lateral masses by a force transmitted from the vertex. Indeed, this mechanism of injury was the one favored by Jefferson in his original review.

The Jefferson fracture is associated with little or no neurological deficit. Because of that and, in general, the poor detail obtained by conventional radiography in a child, these fractures may be overlooked. Conventional tomography may better define the lesion, but CT provides superb definition of this lesion. Indeed, as in our case, the lesion was clearly defined, and healing was demonstrated on sequential studies.

The preferred mode of therapy for this fracture is good immobilization to allow healing to occur. Presently, the halo apparatus is the most popular method of immobilization. However, since it was feared that skeletal pins might penetrate the cranium in this young child, an alternative method of immobilization was sought. A modification of the halo with a skull cap and plastic jacket provided excellent immobilization and a good result.

References


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